

*To inspire the next generation of explorers . . . as only NASA can.*

## INTRODUCTION

This third Annual Report on the NASA Office of Space Science (OSS) Education and Public Outreach (E/PO) program summarizes the hundreds of E/PO products developed and activities carried out during FY 2002 under OSS sponsorship. Examples of the products and activities covered include award-winning educational Web sites, major exhibitions in museums and science centers, partnerships with minority universities, resources for educators, research projects that allow students and teachers to participate in NASA space science missions, and Webcasts and public television broadcasts about major space science research areas. Prominent among these activities is an emphasis on expanding the reach of the OSS E/PO Program to include an increasingly more diverse variety of participants. Such efforts include reaching out to rural communities and students with disabilities, and using organizations such as professional societies of minority scientists to encourage involvement by audiences that have previously not been significant participants in the space science program.

In total, efforts centered on developing some 400 E/PO products and activities are summarized in this report and include the following:

- 71 new educational products registered with the Space Science Education Resource Directory (SSERD) during FY 2002;
- 172 educational activities that directly supported classroom education;
- 30 activities emphasizing targeted outreach to specific audiences or addressing special needs within the education community;
- 31 activities providing support to science centers and planetariums;
- 89 educational activities directed at reaching the general public; and
- 5 activities aimed at encouraging members of the space science community to contribute to E/PO activities and increasing the effectiveness of such efforts.

Taking into account the fact that many of the activities reported involved multiple events that took place in a variety of venues, the total number of E/PO events reported for FY 2002 is more than 3,500—more than a 20-percent increase over the number of events reported in FY 2001. Events took place in all 50 States, the District of Columbia, and Puerto Rico.



More than 3,500 E/PO events took place under OSS sponsorship in FY 2002, encompassing all 50 States, the District of Columbia, and Puerto Rico. (Credit: Southeast Regional Clearinghouse/Craig Anthony)

While accurate information on the numbers of participants in these events is difficult to gather, we can offer the following estimates:

- Over 360,000 teachers, students, and members of the general public were direct participants in OSS-sponsored workshops, community and school visits, and other interactive special events, either in person or via live two-way communications links.
- Over 1.6 million visitors came to museum exhibitions, planetarium shows, public lectures, and special events featuring content from OSS missions and research programs.
- Over 6 million Internet users logged in for Webcasts, Web chats, and other Web events.
- OSS materials and programs were made accessible to some 200 million people through conferences at which there were OSS exhibits or displays, radio and television broadcasts, newspaper columns, or other forms of public media for which precise counts of attendance, viewing audience, or readership were not available.

Complete information on each of these products and activities, including event dates, locations, and participant counts, appears in Appendix A. Summary comments and descriptions of some highlights are contained in the narrative below.

The OSS E/PO efforts described here are only one component of a comprehensive Agencywide education program that, during FY 2002, was designated as a fundamental part of the NASA mission. The OSS E/PO Program is aligned with and strongly supports the new NASA mission **to inspire the next generation of explorers . . . as only NASA can**. The two main elements of the OSS E/PO Program are **to inspire and motivate students to pursue careers in science, technology, engineering, and mathematics** by supporting education in the Nation's schools and **to engage the public in shaping and sharing the experience of exploration and discovery** by supporting informal education and public out-

reach efforts. These are elements that have been central to the OSS E/PO Program since its inception. They are carried out by embedding E/PO within every OSS mission and research program and by relying heavily upon education partners to leverage the unique content resources that OSS brings to E/PO efforts.

The results from our missions and research programs and the scientific and technical expertise of the space science community are the most significant and unique resources that OSS can bring to E/PO efforts. To this end, more than 100 OSS missions and research programs contributed to OSS E/PO efforts in FY 2002. Every OSS flight mission and research program is expected to devote a portion of its resources to E/PO efforts and to include such E/PO efforts as an integral element of its overall program. This approach has created a highly diversified portfolio of E/PO products being developed and activities being carried out in conjunction with mission and research development activities in locations across the country. Adding to this portfolio are innovative space science E/PO programs developed under the Initiative to Develop Education through Astronomy and Space Science (IDEAS) program, projects initiated under the Minority University Education and Research Partnership Initiative in Space Science, projects initiated or coordinated by the OSS E/PO Forums and Broker/Facilitators, and a number of additional comprehensive or special purpose programs managed by OSS at NASA Headquarters. A directory of all the missions and programs that contributed to OSS E/PO efforts in FY 2002, along with references to the specific E/PO products they developed and E/PO activities they carried out, appears in Appendix B.

OSS has made a major commitment to actively engage its community of space scientists in NASA's education efforts. More than 1,000 OSS-affiliated scientists, technologists, and support staff contributed to OSS E/PO efforts in FY 2002, each of whom is acknowledged by name and affiliation in Appendix C. A landmark event to deepen the involvement of scientists in E/PO efforts was the first OSS Education and Public Outreach Conference, held June 14–16 in Chicago, IL. The conference brought together nearly 300 scientists and educators with an interest in space science education and outreach to hear presentations and engage in discussions on what we can learn from science education research, issues and challenges faced by educators in formal and informal venues, and ways in which scientists can most effectively participate in education and outreach.

The OSS approach to E/PO is based on building partnerships with the education community and other organizations engaged in education in order to create products and activities that meet the needs of educators and use multiplier effects to reach as large an audience as possible. In FY 2002, more than 500 institutions and organizations partnered with OSS to develop and implement E/PO programs. The following were among these partners:



E/PO is an integral part of each space science mission. (Credit: NASA Space Telescope Science Institute)

- 20 precollege education organizations, including major curriculum developers such as the Mid-continent Research for Education and Learning (McREL) and the Lawrence Hall of Science; professional societies such as the National Science Teachers Association and the Association of Science-Technology Centers (ASTC), and a number of school districts and boards;
- 12 organizations promoting minority participation in science, including professional societies of minority scientists such as the National Society of Black Physicists and student societies such as the American Indian Science and Engineering Society (AISES);
- nearly 70 community organizations such as the Girl Scouts, the Boys & Girls Clubs of America, and the Civil Air Patrol;
- more than 50 libraries, library systems, and library associations;
- nearly 150 museums, science centers, and planetariums;
- nearly 70 colleges and universities, including 29 minority institutions; and
- more than 90 science institutions and organizations.

A full list of these partners appears in Appendix D. This list includes only those institutions and organizations that served

as full partners by leading the E/PO efforts for OSS missions or programs and/or by leading or contributing substantially to developing OSS E/PO products or activities in FY 2002. Taking into account another 1,500 institutions and organizations whose role was primarily that of serving as additional host sites for OSS E/PO events or exhibits or as media outlets for OSS materials or programs, a total of more than 2,000 institutions and organizations participated in OSS E/PO efforts during FY 2002. All such institutions and organizations are listed in Appendix H according to their geographical location. This appendix also serves as an index, cross-referencing each institution or organization to the descriptions in Appendix A or B of the programs, activities, or products with which they are associated.

Conferences provide an effective means of contact with organizations and individuals engaged in space science E/PO activities. In FY 2002, OSS had a substantial presence at approximately 70 national or regional scientific and education conferences. Exhibits, workshops, materials, and knowledgeable staff were present at such conferences, which provided significant opportunities to discuss space science E/PO resources, opportunities, and issues with conference attendees. These conferences included 22 national education and outreach conferences organized by groups



More than 500 institutions and organizations partnered with OSS to develop and implement E/PO programs in FY 2002. (Credit: Southeast Regional Clearinghouse/Craig Anthony)



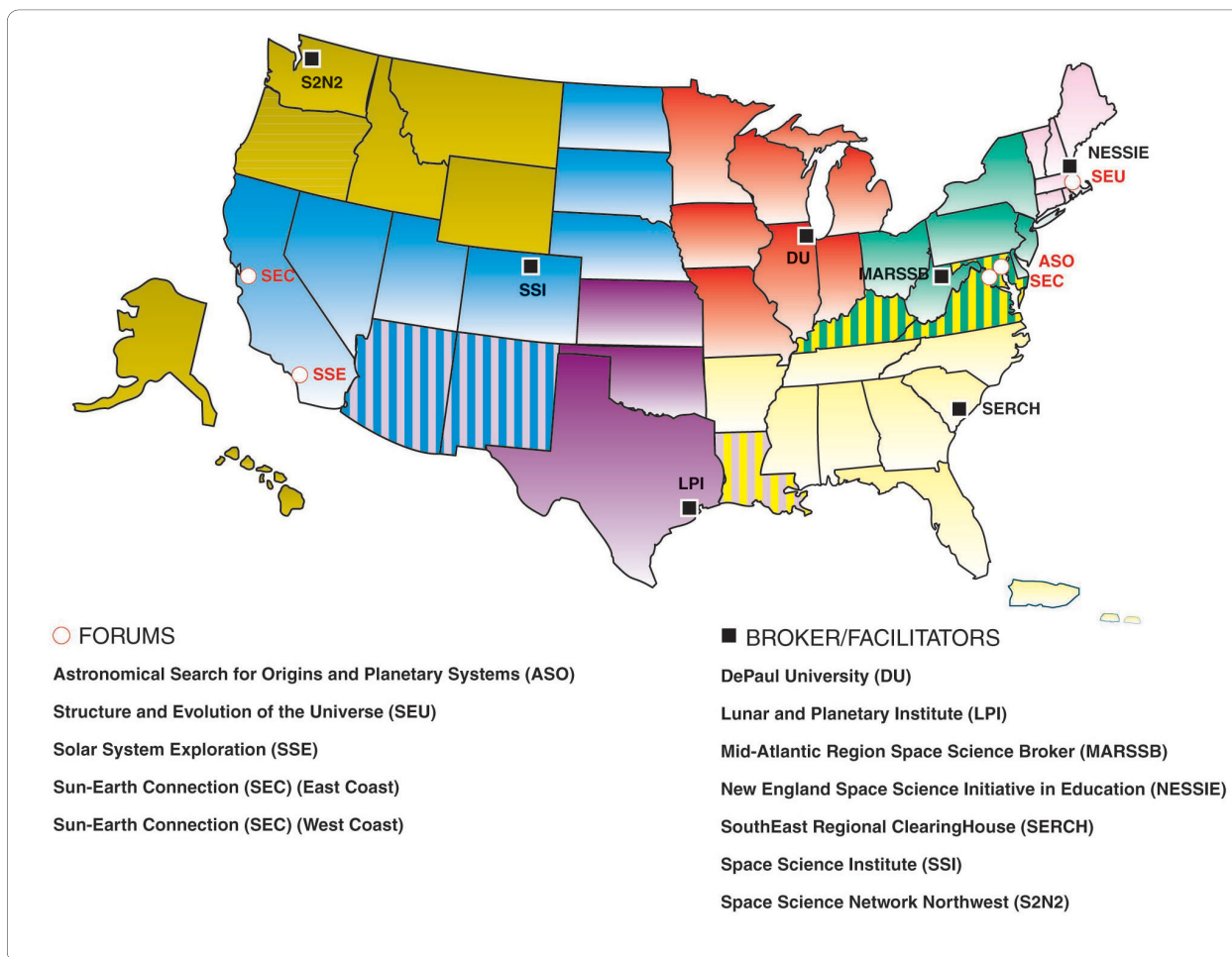
such as the National Science Teachers Association, the International Planetarium Society, and the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers. Also included were more than 30 regional education and outreach conferences sponsored by groups such as regional library associations and State science teacher associations, as well more than a dozen science conferences at which OSS encouraged scientists to more actively participate in E/PO activities. A complete list of the conferences at which there was a significant space science presence in FY 2002 appears in Appendix E.

Coordination and integration of the many OSS E/PO efforts now underway is the responsibility of the OSS E/PO Support Network. The major elements of this network are the theme-oriented Education Forums and the network of regional Broker/Facilitators. The Forums are charged with coordinating the E/PO efforts of OSS's individual space science missions and helping them to make their discoveries and results accessible and readily available to the education community. The Broker/Facilitators are charged with facilitating the involvement of space scientists in education through creating partnerships with educators to carry out high-leverage

E/PO activities. Each Forum is responsible for supporting missions within one of the four OSS research themes: the Astronomical Search for Origins (ASO), Solar System Exploration (SSE), Structure and Evolution of the Universe (SEU), and the Sun-Earth Connection (SEC). Each Broker/Facilitator is responsible for serving space scientists and educators within a specific geographical region.

OSS was pleased to welcome three new Broker/Facilitators to the Support Network in FY 2002: 1) the New England Space Science Initiative in Education (NESSIE), a Boston-area collaboration of the Museum of Science, Tufts University, and the Harvard-Smithsonian Center for Astrophysics; 2) the Mid-Atlantic Region Space Science Broker (MARSSB), an arm of the Center for Educational Technologies at Wheeling Jesuit University in West Virginia; and 3) the Space Science Network Northwest (S2N2), a consortium of seven Space Grant consortia, led by the University of Washington in Seattle. The addition of the S2N2 partners means that 22 out of the 52 Space Grant consortia are now formally affiliated with the OSS Broker/Facilitator program.

Contact information for each of the Forums and Brokers/Facilitators and lists of the E/PO projects in which



The OSS E/PO Support Network consists of four theme-oriented Education Forums and seven regional Broker/Facilitators.

they were most substantially involved in FY 2002 are given in Appendix B. For the many other projects in which they played the background role of catalyzing, coordinating, and facilitating the E/PO activities of others—as well as coordinating the reporting of those activities for this Annual Report—the work of Support Network members is not explicitly mentioned, but it is implicitly assumed and greatly appreciated. The work of the Support Network is central to many of the successes described in this Annual Report.

Because the OSS E/PO Program emphasizes a strategic focus on high-leverage approaches and is carried out through extensive partnerships undertaken in a decentralized way, any attempt to compile information on all of the OSS E/PO products and activities is bound to be incomplete. The information contained here was compiled from information on new products registered in the Space Science Education Resource Directory and from data on activities entered into the OSS E/PO Tracking and Reporting System by the individuals responsible for each E/PO product or activity. This FY 2002 Annual Report should therefore be regarded as a representative—rather than a comprehensive—compilation of OSS E/PO products and activities. Since we know that there were products developed and activities carried out that were not reported through these channels, the statistical information provided continues to represent lower limits for the quantities reported.

The following sections of this report begin by providing information on awards and other forms of public recognition that

the OSS E/PO Program received in FY 2002. They then go on to give statistical summaries and to describe highlights of E/PO efforts in each of the following categories:

- Science Center Shows/Exhibits—planetarium shows and museum or science center exhibitions;
- Targeted Outreach—activities that provide substantial targeted outreach to underserved/underutilized groups;
- Educational Products—products designed for use in classrooms, for enhancing the public understanding of science, and/or for special interest groups; and
- Educational Activities—activities primarily intended to enhance formal classroom education, the public understanding of science, or the involvement of scientists in E/PO.

The examples of products and activities cited in this narrative represent just a few highlights from the rich portfolio of products and activities that are fully laid out in the appendices. The main body of the report concludes with a discussion of program evaluation and a look at future plans for the OSS E/PO Program. Appendices and indices then provide comprehensive details and cross-references on all OSS E/PO products and activities that were reported for FY 2002. Live links and additional search capabilities may be found in the online version of this report at <http://spacescience.nasa.gov/education/> under the link to “Annual Reports.”

*“Chandra has . . . given hundreds of thousands of school children and their teachers a wonderful resource for the classroom.”*

—The Children's Web Surfing Alliance

## AWARD-WINNING PROJECTS

One measure of the success of the NASA Office of Space Science (OSS) Education and Public Outreach (E/PO) Program is the more than 30 awards or other forms of public recognition for excellence in education that OSS E/PO products and activities received in FY 2002. Most significant among them was the Presidential Meritorious Executive Award given by the President of the United States to Dr. Jeffrey D. Rosendhal, OSS E/PO Director, for his leadership in creating and implementing the OSS E/PO Program. This award was a testimony not only to Dr. Rosendhal's leadership but also to the dedication of more than a thousand people throughout the extended NASA space science community who collectively worked to make the OSS E/PO Program a success.

The vast majority of awards received during FY 2002 were for external Web sites providing information on NASA space science missions and educational resources based on that information. Also significant were several major NASA awards recognizing significant contributions of individuals or groups (both inside and outside of NASA) to space science education. Examples of some of these awards are given below, and a list of all the awards reported as being received in FY 2002 appears in Appendix F.

The Navigator program's new **Planet Quest** Web site at <http://planetquest.jpl.nasa.gov/> clearly captured the imagination of a broad segment of the population. **Planet Quest** takes visitors on a “search for another Earth” by providing information and educator resources on the science, technology, and missions involved in finding and characterizing planets orbiting stars other than our Sun. Recognition of the quality and significance of this site came from the science education community through awards that included the Eisenhower National Clearinghouse's Digital Dozen Award, *Discover Magazine's* Pick of the Web award, Griffith Observatory's Star Award, and a National Academy Press designation as a Coolest Science Site. Recognition of its appeal to the general public came through a Time Warner Cable Best of the Web Award, and a Yahoo.com designation as a Yahoo! Pick and one of Yahoo!ligan's Five Coolest Sites.

The Chandra X-Ray Observatory Center's Web site at <http://www.chandra.harvard.edu/>, added to the awards it has

received in past years from the science and education communities, with a number of new awards in FY 2002 coming from sources serving the general public. These new awards included the lightOS.com 8th Annual Golden Ace Award for Science, a CPSnet Ocean of Knowledge Seal, and designations as a UKBest50 Best 50 Astronomy Site, an America Online AOL Hot Link, and a USA Today Hot Site. The Chandra site also received accolades from the Children's Web Surfing Alliance for the easy-to-read format and the rich detail that it offers. The Chandra site serves as an “Outpost” on the alliance's CyberSurfari.Org Web site—a site that is devoted to educational development for teachers, students, and families regarding the vast opportunities and benefits available through strong online navigation skills.

Hubble Space Telescope online outreach Web site at <http://hubble.stsci.edu> received public recognition as a *New Scientist* magazine Web Pick, a *PC World* magazine Best of the Web site, and a Suite101.com Top Five Web site for science.

**Ciencia@NASA**, the Spanish-language version of NASA Marshall Space Flight Center's popular Science@NASA Web site, was recognized by Yahoo! International as the Best Spanish Science and Technology Web Site. The Astro-materials Program Curation Web Site at <http://curator.jsc.nasa.gov/> and the Hubble Space Telescope's Amazing Space Web site at <http://amazing-space.stsci.edu/> were added to the National Science Teachers Association's (NSTA) continually growing list of NASA space science sites designated as NSTA sciLINKS. Other NASA space science sites that received public recognition in FY 2002 included the **Galileo: Journey to Jupiter** Web site at <http://galileo.jpl.nasa.gov/>, which was designated as an American Library Association Great Web Site for Kids; the New Millennium Program's **Space Place** Web site at <http://spaceplace.jpl.nasa.gov/>, which received an Ask Jeeves Silver Platter Award; and the NASA **Solar System** Web site at [http://www.jpl.nasa.gov/solar\\_system/](http://www.jpl.nasa.gov/solar_system/), which was designated as a Marco Polo Education Foundation Science NetLink.



The award-winning **PlanetQuest** Web site keeps count of extrasolar planets as they are discovered. (Credit: NASA Jet Propulsion Laboratory/Randal Jackson)



**Ciencia@NASA** brings NASA research to the broad community of Spanish language speakers. (Credit: Marshall Space Flight Center)

Major NASA awards given in FY 2002 for significant E/PO efforts included a NASA Group Achievement Award given by NASA Jet Propulsion Laboratory (JPL) to the Mars Public Engagement program for its efforts in supporting the Odyssey Mars Orbit Insertion and a NASA Exceptional Achievement Medal given by JPL to Nancy Leon for her leadership of [Space Place](#), the cornerstone of outreach efforts for NASA's New Millennium Program. In addition, NASA Goddard Space Flight Center (GSFC) gave a GSFC Award for Excellence in Outreach to Dr. Steele Hill for his work with the Solar and Heliospheric Observatory (SOHO).



*“The exhibit helped me know what the Universe was like. . . . it made me really think about it.”*

—A 9-year-old visitor to *Cosmic Questions*

## SCIENCE CENTER SHOWS/EXHIBITS

The debut of a scale model Solar System on the National Capitol Mall and the opening of a major traveling exhibition on the past, present, and future of the Universe highlighted the extensive presence of NASA space science in science centers, museums, and planetariums in FY 2002. Nearly 150 such institutions partnered with the Office of Space Science (OSS) in FY 2002 by contributing substantially to developing exhibitions, planetarium shows, materials, or other activities based on OSS content. Taking into account the many other institutions that participated by serving as additional host sites for exhibitions, planetarium shows, displays, or other educational activities based on OSS content, a total of nearly 300 science centers, museums, and planetariums in 45 States, the District of Columbia, Guam, and Puerto Rico participated in OSS Education and Public Outreach (E/PO) efforts in FY 2002. Combining the educational expertise and audience reach of these institutions with the materials, technical expertise, and other resources available from OSS missions and research programs creates important opportunities for using the results of NASA space science missions to improve the public understanding of science and technology. Examples of some of the more visible outcomes from such opportunities are described below. Detailed descriptions of these and other OSS projects with science centers, museums, and planetariums appear in Appendix A.

On October 17, 2001, *Voyage: A Journey Through Our Solar System* opened on the National Mall in Washington, DC.



Visitors to the National Capitol Mall encounter *Voyage*, a one ten-billionth scale model of the Solar System. (Credit: NASA/Renee Bouchard)

Developed by the Challenger Center for Space Science Education in Alexandria, VA, in collaboration with NASA and the Smithsonian Institution, *Voyage* is an accurate, one ten-billionth scale model of the Solar System composed of 13 viewing stations sited along a 600-meter path from the National Air and Space Museum to the Smithsonian's Castle. At each station, visitors can view a three-dimensional, laser-sculpted replica of the world they are standing near. They can also see the locations of nearby worlds marked by viewing stations that are easily visible in the distance. Porcelain enamel graphic panels on each viewing station place the visitor at the planet in seemingly familiar locations, such as standing on the planet's surface looking up at the sky. Because *Voyage* is placed in its location on the National Capitol Mall for the next 15 to 20 years, it will not travel to other museum sites. Instead, its designers hope to replicate it for permanent placement at other sites around the world. Educational materials and supplementary information on *Voyage* are available at <http://www.voyageonline.org>.

*Cosmic Questions: Our Place in Space and Time*, a 5,000-square-foot exhibition that invites audiences to explore fundamental questions and recent discoveries about the origin, evolution, and structure of the Universe, opened at the Museum of Science in Boston on September 19, 2002. Among other activities, this highly interactive exhibition offers visitors a chance to go beyond the visible and observe what the Universe would look like if they could see infrared light or x-rays, journey to a black hole and study it from a virtual orbiting observatory, discover what it's like to be an astronomer, make the acquaintance of observers on a Hawaiian mountaintop, meet a team that is launching a great observatory into space, and program a remote telescope to take a picture of a selected object. *Cosmic Questions* was developed through a partnership between the Boston Museum of Science and the NASA Structure and Evolution of the Universe Education Forum at the Harvard-Smithsonian Center for Astrophysics, with major funding provided by the National Science Foundation. Beginning in February 2003, *Cosmic Questions* will travel to science centers and museums across the country under the auspices of the Association of Science-Technology Centers. At each stop on its tour, *Cosmic Questions* will provide professional development workshops for teachers and museum staff as well as a package of activities and demonstrations that the museum staff may use to provide informal learning opportunities for museum visitors.

Also making its debut in FY 2002 was *Northern Lights*, a planetarium show tailored for smaller planetariums that emphasizes audience participation in exploring the beauty and causes of auroras. For example, visitors can partake of the beauty of the aurora by using fluorescent chalk to sketch images of the aurora that they have just seen, and they can view their drawings glowing under black lights. In addition, participants interactively learn about seasons, sunrises, and





In the cosmic kitchen, visitors to the [Cosmic Questions](#) exhibition learn that in order to make apple pie, you must first make the Universe. (Credit: Smithsonian Astrophysical Observatory/Kevin Burke)

sunsets. [Northern Lights](#) was developed through a collaboration between the NASA Sun-Earth Connection Education Forum and the Lawrence Hall of Science (LHS). Scientific expertise and multimedia resources were provided by the Fast Auroral Snapshot Explorer, the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE), and other NASA missions. Since its release in the early summer of 2002 as part of the LHS audience participatory program series, Planetarium Activities for Student Success (PASS), [Northern Lights](#) has been distributed as a kit to over 75 planetariums nationwide. It is also being distributed with every Starlab inflatable planetarium sold. The [Northern Lights](#) kit includes a guide with the script, the scientific background, classroom activities, a video or DVD, and a slide set.

A number of major OSS space science exhibitions that were developed in previous years continued their national tours in FY 2002. [Hubble Space Telescope: New Views of the Universe](#), a 5,000-square-foot exhibition designed to immerse visitors in the magnificence and mystery of the Hubble mission, continued its 4-year tour with stops at the Kennedy Space Center Visitor Center in Florida and at Union Station in Kansas City, MO. Meanwhile, the smaller, 2,500-square-foot version of the exhibition visited the Discovery

Center in Bridgeport, CT. [MarsQuest](#), a 4,500-square-foot traveling exhibition that invites visitors to share in the excitement of the scientific exploration of Mars, made stops at the Catawba Science Center in Hickory, NC; the Virginia Air and Space Museum in Hampton, VA; and the Peggy Notebaert Nature Museum in Chicago, IL. The [Space Weather Center](#), a 700-square-foot exhibit that shows viewers how space weather (disturbances in space driven by solar activity) plays a role in their everyday lives, was on display at the Adler Planetarium and Astronomy Museum in Chicago, IL; the Insights El Paso Science Museum in El Paso, TX; and Wayne County Community College in Belleville, MI. In addition, [Explore the Universe](#), an exhibition that displays the Hubble Space Telescope (HST) backup mirror, continued to be on display at the Smithsonian National Air and Space Museum. The HST back-up mirror is the centerpiece of observational tools that astronomers have devised over the past four centuries to understand the Universe.

Over a hundred small planetariums and science centers around the country were served by [ViewSpace](#), a series of multimedia presentations that show regularly updated images from Hubble Space Telescope (HST) and other NASA space science missions in their galleries. A museum or planetarium that wants to use [ViewSpace](#) provides an exhibit area with a PC, a display device (large monitor, LCD projector, or plasma screen), a small sound system, and an Internet connection. The Space Telescope Science Institute then provides the [ViewSpace](#) exhibit content. [ViewSpace](#) presentations orchestrate high-resolution images, digital movie clips, and minimally intrusive text together with an appropriate musical background. [ViewSpace](#) is currently being distributed via CD, but it will soon transition to an Internet distribution model that will allow automated delivery of the latest news and images from Hubble (and other missions) as soon as the information is released. In addition to the enhanced timeliness, the Internet version will soon offer expanded programming in the form of "Fun Facts" challenge quizzes and news updates from around the NASA/OSS mission world.

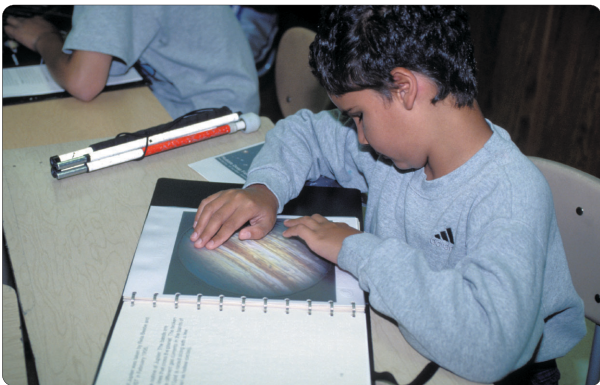
## *“Science is for blind children too!”*

—Barbara Cheadle, President,  
National Organization of  
Parents of Blind Children

### TARGETED OUTREACH

Targeted outreach projects are those that emphasize meaningful participation in NASA Office of Space Science (OSS) activities by individuals from groups that are currently underserved and underutilized in science and technology. These projects are motivated by the recognition that meeting the future needs of a society based on science and technology requires the involvement of all Americans. While OSS encourages the inclusion of participants from underserved and underutilized groups in all education and public outreach (E/PO) projects, some projects make such involvement their primary focus. Examples of several FY 2002 projects that targeted underserved and underutilized groups are given below. Descriptions of these and other targeted outreach projects may be found in Appendix A.

After years of anticipation and planning, *Touch the Universe: A NASA Braille Book of Astronomy* was published by the Joseph Henry Press of the National Academy of Sciences. Born from a simple idea, a modest E/PO supplement to a Hubble Space Telescope Guest Observer grant, and a collaboration between an astronomer (Dr. Bernard Beck-Winchatz of DePaul University), a planetarium educator (Noreen Grice of the Museum of Science, Boston), and a teacher (Ben Wentworth of the Colorado School for the Deaf and Blind), *Touch the Universe* is a 64-page book that makes the magnificent images taken by the Hubble Space Telescope (HST) accessible to visually impaired students. Each image is printed in color and then the pages are embossed so that color features are represented by various raised symbols and textures. The accompanying explanatory text is given in both



Tactile images in *Touch the Universe* make Hubble Space Telescope images come alive for students with visual impairments. (Credit: Colorado School for the Deaf and Blind)



Students at Alabama A&M University learn how to adjust a telescope. (Credit: Alabama A&M University/Arjun Tan)

Braille and large print so that readers of all visual abilities are able to view and read the book together. Formal unveilings of the book were planned for early FY 2003 at the National Federation of the Blind in Baltimore, MD, and at DePaul University in Chicago, IL. Copies of the book may be ordered from the Joseph Henry Press at <http://www.jhpress.org>.

In a continuing effort aimed at developing space science capabilities at minority universities, 15 minority institutions first funded in FY 2001 continued to make excellent progress under the NASA Minority University Education and Research Partnership Initiative in Space Science. By the close of FY 2002, these institutions collectively reported being engaged in research collaborations with 9 NASA space science missions or suborbital projects and in more than 30 working partnerships with major space science research groups. In academic programs, the 15 minority institutions collectively reported having established on their campuses 22 new or redirected space science faculty positions, 11 new or revised space science degree programs, and 66 new or revised space science courses. Notable among these programs was a new systemwide space science degree program established at the City University of New York (CUNY) that is open to students at any college within the CUNY system.

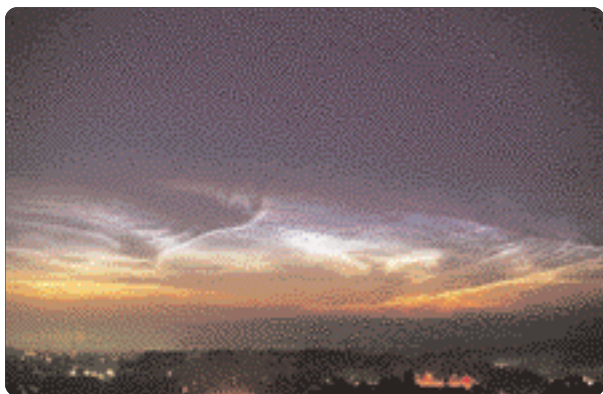
The 15 minority institutions also engaged in a wide variety of teacher training, precollege outreach, and public outreach programs serving constituencies in their local communities. Unique among these programs was an effort developed by the University of Hawaii at Hilo (UHH) to blend traditional Polynesian knowledge of the sky with the concepts of current NASA astronomy research. *New Opportunities Through Minority Initiatives in Space Science (NOMISS)* includes a redesigned undergraduate astronomy curriculum at UHH that features hands-on work with astronomical instruments, cultural information, and internships provided through partnerships with the major observatories on Mauna Kea. A precollege component of *NOMISS* brought K–12 teachers on summer retreats and to cultural protocol workshops where classroom activities were blended with excursions to cultural sites, including Mauna Kea. The participating teachers now are



A stone Star Compass introduces teachers to Polynesian celestial navigation. (Credit: University of Hawaii at Hilo/Alice Kawakami)

designing and implementing curriculum activities to increase their students' learning about culture, mathematics, and science—particularly astronomy. Public interest in **NOMISS** is high, as the Hawaiian community focuses on bringing together diverse perspectives about space science on Mauna Kea, which is both a major focal point of traditional Hawaiian culture and one of the best observational astronomy sites on Earth.

Beyond the baseline of activities established through the space science minority university initiative, significant involvement of a minority university in the OSS scientific program occurred at Hampton University where, as a result of an open, competitive peer review process, Hampton's Aeronomy of Ice in the Mesosphere (AIM) mission was selected for flight under the Small Explorer (SMEX) Program. This success gave Hampton University the distinction of being the first Historically Black College or University (HBCU) ever to be given the lead responsibility for conducting a complete space flight mission. AIM will determine the causes of noctilucent clouds—the highest altitude clouds in the Earth's atmosphere—and their impact on global climate. Hampton students will be significantly involved in conducting and analyzing the data from the AIM mission. In addition, a national E/PO Program associated with AIM will use the beautiful images of noctilucent clouds to motivate interest, learning, and a deeper understanding of the issues surrounding changes in the Earth's atmosphere.



Noctilucent clouds are the subject of Hampton University's AIM mission. (Credit: Oscar Van Der Velde/image location: <http://www.lightningwizard.com>)

OSS also continued to work with professional societies of minority scientists in order to broaden the diversity of participants in OSS missions and E/PO projects and to improve the effectiveness of OSS support for the activities of these professional societies. In this work, an emphasis is placed on engaging society members as consultants and partners and on establishing collaborations early in the planning process for major activities or programs. Among the outcomes from this effort in FY 2002 was that minority scientists identified through the professional societies' network began to serve on the E/PO planning and advisory committees for the OSS Navigator Program and the Cassini/Huygens mission to Saturn. In addition, OSS supported activities of the professional societies through an enhanced presence at the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) and the American Indian Science and Engineering Society (AISES) conferences (in early FY 2003). OSS also supported the professional societies by becoming a sponsor of the Richard Tapia Celebration of Diversity in Computing conference, celebrating the technical contributions and career interests of diverse people in computing fields.

In a continuing effort to inspire young girls to consider careers in science, mathematics, and technology, the NASA Solar System Exploration Forum at the Jet Propulsion Laboratory led OSS involvement in a collaboration with the Girl Scouts of the USA (GSUSA). By working with GSUSA councils and the GSUSA national headquarters, OSS is able to provide training for master trainers, articles for the national *Leader* magazine, content for the GSUSA Web site, and other national resources. Working through these avenues presents an opportunity to reach more than 3.2 million Girl Scouts, as well as their parents and almost 1 million adult members. During FY 2002, preliminary steps were taken to solidify this relationship through a formal agreement with GSUSA. Completion of these arrangements is expected in FY 2003.



*“Teachers and Museum staff observe that space science sparks children’s interest more than any other scientific subject, with the possible exceptions of robots and dinosaurs.”*

— PERG Interim Evaluation Report

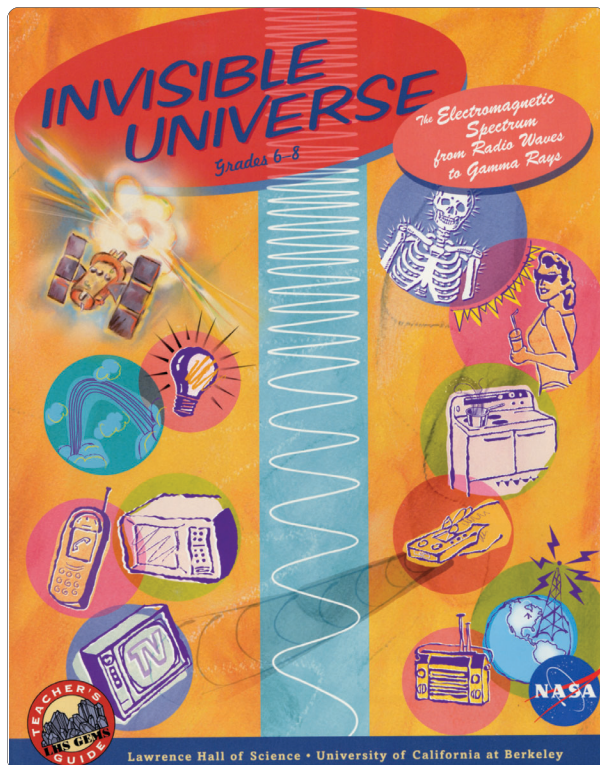
## EDUCATIONAL PRODUCTS

Providing educational products that use space science missions and discoveries to enhance what is taught in the classroom is a major facet of the NASA Office of Space Science (OSS) Education and Public Outreach (E/PO) Program. The development of such products is typically undertaken by one or more OSS missions or researchers working in collaboration with professional educators. The OSS E/PO Support Network provides guidance in the development of products, serving as consultants and in some cases coordinating and leading the development of major products that draw on the content of a number of missions. Examples of two new products are given below, and

Appendix A of this Annual Report contains descriptions of more than 70 new products that were reported as having been developed during FY 2002.

**Invisible Universe: The Electromagnetic Spectrum from Radio Waves to Gamma Rays** is a set of middle school classroom activities created through a collaboration between the Swift gamma-ray-burst mission and the Lawrence Hall of Science (LHS). The booklet contains five thoroughly tested activities that use the mystery of gamma-ray bursts as an engagement tool to teach students about the electromagnetic spectrum, the different ways astronomical objects emit energy across the spectrum, and how astronomers detect these objects. It is being released as part of LHS’s Great Explorations in Math and Science (GEMS) series. GEMS guides are currently used collectively in approximately 25 percent of the country’s school districts and thus provide an excellent opportunity to reach large numbers of students.

**Total Eclipse: Solar Eclipses and the Mysteries of the Corona** is a new video and DVD that explores the science behind eclipses and how these events can provide insight into the dynamic nature of the Sun and its effects on Earth and society. The video, produced by the Exploratorium and NASA’s Sun-Earth Connection Education Forum, features the best footage of recent total solar eclipses as viewed from the Caribbean, Turkey, and Africa. The modular 30-minute program covers the mechanics of eclipses, the history of human interest in eclipses, the role of eclipses in the study of the solar corona, and the importance of NASA Sun-Earth Connection research on our modern understanding of the Sun.



*Invisible Universe* guides learning about the electromagnetic spectrum.

The Space Science Education Resource Directory (SSERD) an online repository of OSS educational resources that is hosted by the Space Telescope Science Institute. Through the SSERD, products that are available for widespread distribution are made available to educators, who may visit the SSERD at <http://teachspacescience.org> and search for and obtain the materials in which they are interested. The SSERD is compatible with and linked to major national educational databases such as the U.S. Department of Education’s Gateway to Educational Materials (GEM) that are familiar to and widely used by teachers. Educators seeking materials can easily search the Resource Directory by keyword, browse the directory by topic, or conduct advanced searches by using any combination of keywords, grade levels, formats, and subjects. These search capabilities are continually being upgraded and expanded, based on feedback and requests from users.

One main objective of the SSERD is to become a one-stop shopping site for space science materials. It is critical to ensure that educators can not only find materials in the SSERD, but that they can also easily obtain those materials for their own use. In prior years, only those resources that were available electronically over the Internet were included.



For such items, the SSERD gives users a link either to the resource's own Web site or to a downloadable PDF file. During FY 2002, the SSERD established a partnership with the NASA Central Operation of Resources for Educators (CORE) through which the capability of ordering some products in multimedia hard-copy forms (such as CD-ROM, videotape, or DVD) was added. Beginning early in FY 2003, users seeking such audiovisual materials may download a printable order form and mail it, with payment for minimal reproduction and shipping charges, to CORE. CORE will then ship a copy of the desired material to the user requesting it. It is hoped that in future years this procedure can be upgraded to a direct online-ordering system in which orders can be placed from within the SSERD and transmitted electronically to CORE. In addition, steps are being taken to begin acquiring one or more commercial partners to provide similar services for printed materials.

Another objective of the SSERD is to give educators some helpful guidance as to the quality and utility of the many resources contained within it. To this end, a product review process has been initiated. During FY 2002, 46 OSS products drawn from across the four OSS theme areas were evaluated and rated by panels of scientists and educators. Procedures are being implemented so that products receiving exemplary ratings in such reviews will be highlighted within the SSERD.

At the end of FY 2002, there were more than 450 space science products registered in the SSERD. Approximately 275 of these products were available electronically over the Internet and, therefore, were accessible to searches by SSERD users. The remaining products were available only as hard-copy or audiovisual materials and, therefore, were not yet accessible to searches by SSERD users until broader distribution mechanisms are in place.



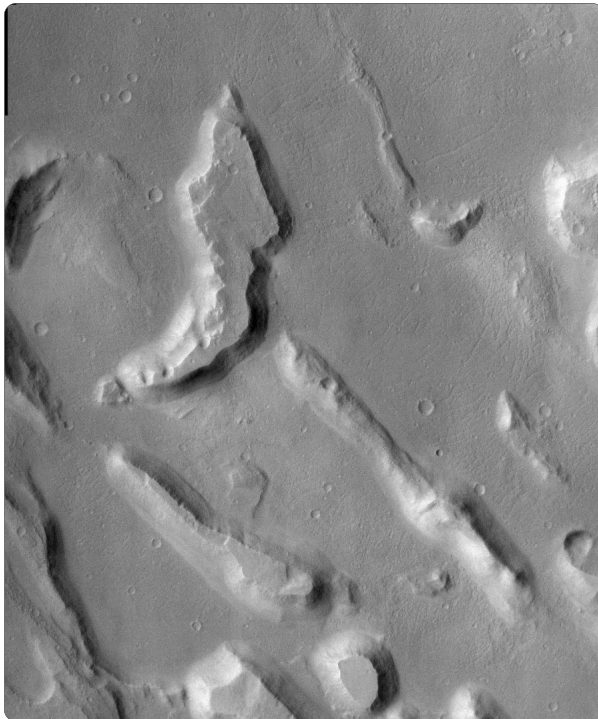
The Space Science Education Resource Directory gives educators access to a wide variety of OSS E/PO materials.

*“This program . . . is a once in a lifetime experience for all the students participating.”*

— A seventh-grade student  
commenting on MSIP

## EDUCATIONAL ACTIVITIES

In FY 2002, the NASA Office of Space Science (OSS) sponsored more than 170 educational activities that directly supported classroom education at the precollege level, and some 90 educational activities that were directed specifically to the general public. Through these two areas, OSS contributed to inspiring and motivating students to pursue careers in science, technology, engineering, and mathematics by supporting education in the Nation's schools and by engaging the public in shaping and sharing the experience of exploration and discovery. OSS also sponsored a number of activities that were aimed at encouraging members of the space science community to contribute to education and public outreach (E/PO) activities and at improving the effectiveness of their participation. Further comments on and examples of some highlights of these educational activities are given below. Detailed descriptions of these activities appear in Appendix A.



Images of Mars from the Odyssey spacecraft are used for student research projects. (Credit: NASA Jet Propulsion Laboratory/Arizona State University)

The OSS policy of embedding E/PO efforts within each mission and research program generates unique opportunities for students to work directly with NASA space science missions, data, and personnel. This is particularly important for students of high school or even younger ages where having such an experience can easily influence career choices. For example, the [Mars Student Imaging Project \(MSIP\)](#), conducted at the Arizona State University Mars Imaging Facility, offers middle school, high school, and undergraduate student teams the opportunity to participate directly in the scientific exploration of Mars. A percentage of the pictures taken by the Thermal Emission Imaging System (THEMIS) instrument on the Mars Odyssey 2001 spacecraft are dedicated to student use. Student teams submit proposals to take pictures of specific regions of Mars in order to answer specific scientific questions that they pose. Teams whose proposals are selected participate in acquiring the images, analyzing the data, and presenting their findings. At least one-quarter of the imaging-team slots are reserved for underrepresented groups (minority, female, rural, and inner-city), which are recruited through contacts with minority institutions and other programs. In addition to direct student participation in onsite mission operations, opportunities for more students are being created through distance learning and through a special archived-image library of data that is being developed using data from all of NASA's past, present, and future Mars missions.

The [MicroObservatory](#) network of online telescopes, operated by the NASA Structure and Evolution of the Universe (SEU) Education Forum, allows middle and high school teachers and their students to investigate the night sky from their classrooms. By means of a Web interface, students access the five robotic telescopes in the network and specify observing parameters such as the target, exposure time, and filter. Located at sites around the world, the telescopes have a combined capability of making a quarter of a million observations each year. Students in 20 States now use the telescopes to carry out investigations, ranging from the distance to the Moon to the expansion of the Universe. Studies conducted by the Chandra X-Ray Observatory and the SEU Forum indicate that students who carry out investigations using these telescopes show significant gains in their understanding of astronomy and physical science concepts and in their ability to solve math problems associated with these subjects.

The [Chicago Teachers' Advisory](#) is one example of how OSS is contributing to systemic reform initiatives being undertaken in various parts of the country. The DePaul Broker/Facilitator has developed a partnership with Chicago teachers that is aimed at developing ways to bring space science to the schoolchildren of Chicago. [Advisory](#) meetings occur one to two times a year and attract a broad group of teachers who are representative of the Chicago Public Schools system. The January 2002 meeting attracted 120 teachers from the Chicago area to focus on integrating space



Astronomer James Kaler (left) and Native American storyteller Lynn Moroney (right) share ideas. (Credit: DePaul University/Victoria Simek)

science with reading, writing, and the arts. Lynn Moroney, a Native American storyteller, and Dr. James Kaler, an astronomer from the University of Illinois, gave plenary addresses which showed how much the crafts of storytelling and modern astronomy have in common. Teachers who are members of the [Chicago Teachers' Advisory](#) planned the meeting, led several breakout sessions, and then took the lead in developing follow-up activities. One team of 10 teachers is now building on literacy and science ideas to develop a thematic unit that incorporates storytelling and reading strategies, big ideas in science, and NASA space science discoveries. Another group of teachers will become certified in the use of the StarLab portable planetariums demonstrated at the symposium.

Numerous workshops for individual teachers were also conducted by the E/PO elements of OSS flight missions and research programs in FY 2002. These workshops offered teachers the opportunity to experience some of the excitement of conducting space science flight missions and to increase their understanding of the discoveries made by such missions and research programs. In many cases, teacher guides and classroom activities based on the missions or programs were provided as part of the workshop. The subject areas covered a wide range of topics. For example, the Stratospheric Observatory for Infrared Astronomy (SOFIA) and the Space Infrared Telescope Facility (SIRTF) combined their efforts to produce [Beyond the Visible Universe: Teaching Invisible Astronomy](#), a workshop on infrared astronomy that included demonstrations with an infrared camera, provided resource materials for the teachers and college instructors who participated, and gave a view of the future of infrared astronomy. The NASA Astrobiology Program's [Living in the Microbial World and Extremophiles: Life on the Edge](#) workshops examined microbial diversity, the evolution of some of the earliest ecosystems on Earth, and the extreme environments in which life can survive. The Astromaterials Program's [Rocks from Space](#) workshops were collaborations between scientists at NASA Johnson Space

Center and Texas educators to train other educators in using extraterrestrial materials to teach not only Earth and space science, but also chemistry and physics.

Many workshops took place at major national educator conferences such as the National Science Teachers Association (NSTA) meeting in San Diego, CA, the National Council of Teachers of Mathematics (NCTM) meeting in Las Vegas, NV, and the International Technology Education Association (ITEA) meeting in Columbus, OH. Typically, workshop presenters also staffed a major OSS E/PO exhibit booth, providing a place where teachers could examine materials and discuss them with the OSS staff present at the booth. Teacher workshops were also conducted at regional educators conferences, at museums and science centers in conjunction with major OSS exhibitions, and at numerous other venues throughout the country.

Beyond such direct interactions, OSS also used public television and other media to expand the reach of its educational activities. For example, the Passport to Knowledge (P2K) series produced by Geoff Haines-Stiles Productions, Inc., continued its partnership with OSS through the production and broadcast of two [Live from Mars](#) specials during FY 2002. The first special originated live from the NASA Jet Propulsion Laboratory on October 30, 2001, just one week after the Mars Odyssey spacecraft entered its orbit around Mars. The second special was broadcast live from the Mars Imaging Facility at Arizona State University on March 19, 2002, and featured the first results from Odyssey's infrared camera, literally "live from Mars." In both specials, students in locations around the country interacted live with NASA managers and researchers. Each special was broadcast by more than 125 public television stations and simultaneously on NASA TV, reaching an estimated audience of more than 10 million teachers and students. Sequences related the exploration of Mars to key space and Earth science topics that are found in State and national science standards. Companion Web resources provided original biographies and journals, allowing the men and women behind the Odyssey spacecraft to describe their career paths and personal commitment to exploring the Solar System.



Project Manager Roger Gibbs describes the Mars Odyssey spacecraft, [Live from Mars](#). (Credit: Passport to Knowledge/Geoff Haines-Stiles)





Sun-Earth Day focuses attention on the Sun and its impact on life on Earth. (Credit: Sun-Earth Connection Education Forum)

Direct outreach to the public was accomplished in FY 2002 through activities such as [Sun-Earth Day](#), a national event created by the NASA Sun-Earth Connection Education Forum (SECEF) to celebrate the Sun, the space around Earth (geo-space), and how all of it affects life on our planet. The second annual [Sun-Earth Day](#) was held on March 20, 2002, with the “Celebrate the Equinox” theme. It featured programs and activities at NASA Centers and a 2-hour televised Webcast featuring discussions on the Sun’s connection to the Earth through images, cultural parallels, and activities that Native Americans have used to share Sun-Earth science through several generations. Groups in classrooms, museums, shopping malls, planetariums, and auditoriums around the world participated through numerous special events arranged with materials provided by SECEF. The special [Sun-Earth Day](#) events directly involved more than 30,000 people, while the broadcast and Webcast reached millions of additional individuals.

More than a thousand OSS-affiliated scientists, technologists, and support personnel contributed to OSS E/PO efforts

in FY 2002 (see Appendix C). Although this is more than a 15 percent increase in the number of such persons who reported contributing to OSS E/PO efforts in FY 2001, these individuals still represent only a small fraction of the potentially available OSS science community. In FY 2002, OSS therefore continued its efforts to encourage and to improve the effectiveness of scientists’ participation in E/PO activities. The OSS E/PO Support Network provided exhibits and/or conducted workshops at a dozen major meetings of scientists. These efforts were aimed at increasing scientists’ familiarity with OSS E/PO efforts and current education practices, and increasing their participation in E/PO activities. These meetings included those of professional societies such as the American Astronomical Society and the American Geophysical Union, as well the annual Lunar and Planetary Sciences Conference (see Appendix E). In addition, more extensive workshops for scientists interested in E/PO were conducted by the Space Science Institute.

In June 2002, the first national [NASA Space Science Education and Public Outreach Conference](#) was held in Chicago with the goals of strengthening and deepening OSS E/PO efforts and, in particular, of enhancing the ability of the space science community to contribute to these efforts. The importance of E/PO to NASA’s space science program was underscored by the opening keynote speaker, Dr. Edward J. Weiler, NASA’s Associate Administrator for Space Science. Dr. Weiler emphasized the point that education is part of NASA’s core mission and that enhancing the quality of science, mathematics, and technology courses, particularly at the precollege level, is key to accomplishing that mission. Among the topics discussed at the conference were ways to better reach members of underserved communities, including people with special needs; the creation of professional development opportunities for educators; the establishment of standards for programs; and better ways to access and disseminate information from NASA space science missions. These discussions helped identify areas requiring attention in the future—areas that also emerged from the more formal evaluation studies described in the next section.



*“A solid foundation has been established...”*

— *Space Science Advisory  
Committee E/PO Task Force*

## EVALUATION

Significant feedback on the quality of the NASA Office of Space Science (OSS) Education and Public Outreach (E/PO) Program and its effect on the audiences it serves came during FY 2002 from three major sources. First, discussions at the NASA Space Science E/PO Conference in Chicago resulted in substantial critical feedback from scientists and educators who were themselves actively engaged in space science E/PO efforts. Second, the E/PO Task Force chartered by the NASA Space Science Advisory Committee (SScAC) presented its preliminary assessment of how well OSS has succeeded in implementing its E/PO Implementation Plan—which is the foundation of its whole approach to education. This Task Force also considered whether any significant changes in the process, content, or direction of the OSS E/PO Program are needed. Finally, the Program Evaluation and Research Group (PERG) of Lesley University presented its first report from Phase III of its ongoing program evaluation studies of the impact of OSS E/PO efforts on its intended audiences. The feedback from all three sources came to similar conclusions, the highlights of which are summarized below.

All three sources pointed to the substantial progress that the OSS E/PO Program has made over the past several years. The scope and breadth of products and activities, the increased participation of minorities in OSS activities, and the program infrastructure that has been established are seen as having had a significant national impact and as having



Critical examination is the key to success. (Credit: Sun-Earth Connection Education Forum/Lou Mayo)

offered a solid foundation upon which to build future activities. Much credit for these successes was given to the OSS policies of embedding E/PO in each space science mission and research program, of engaging the space science community in E/PO, and of relying heavily on leveraged support from a large number of external education partners.

All sources of feedback indicated that the most important issue needing to be addressed is coherence. There is a generally recognized need to build much greater coherence among the many NASA space science educational products being produced through the OSS E/PO Program. In the current system, many space science missions create individual E/PO products and materials based on the scientific and technical content of their own missions. The result is a plethora of space science E/PO products covering a broad range of topics with a broad range of approaches. While this method offers the education community many choices of products, it also induces confusion. Some products may overlap with or duplicate the topics addressed by other products, leaving teachers uncertain as to which product would be best to use for that topic. Meanwhile, other critical topics may not be addressed by any product at all.

To mitigate these problems, the education community strongly recommended that OSS develop an overarching curricular framework that would organize space science educational products in a coherent manner, indicating how such products fit into the requirements of the classroom at various grade levels. Such a framework would be tied to science education standards at each level and would introduce each topic in a sequential manner that would be built upon in subsequent years. Having such a framework would make it easier for educators to use the space science materials in their classrooms. It would also give each of the OSS missions a common basis for determining what types of new materials would be the most useful to develop with an increased focus on quality for those materials that are produced.

The feedback sources also indicated that there is a need for increased professional development opportunities for the implementers of NASA space science education programs. One consequence of having embedded the OSS E/PO Program within the missions and research programs is that a new profession of space science E/PO specialists has been created. These specialists are typically employed by the institutions that manage space science missions and carry out the space science research programs. They have the job of actually planning and carrying out the E/PO efforts of the missions or programs that employ them. While some of these E/PO specialists have formal training in education, many of them do not. They are typically scientists or technologists who have adopted education as a new career. Thus, it is critically important to provide this new community of E/PO specialists with opportunities to learn the practical aspects of developing E/PO activities and products that are based on the

best knowledge and practices of the professional education community. This step will help make the OSS E/PO community a more effective agent at bringing together science content with education needs.

Finally, the sources cited a need to make NASA space science educational products more readily accessible to educators. The NASA Space Science Education Resource Directory (SSERD) is a welcome first step in this direction, but its utility is hampered by a number of unresolved issues. Publicity about the SSERD is inadequate, leaving many educators unaware of its existence. At the present time, the SSERD does not allow searches by standards or by lesson

time, nor does it give indications of the quality of the materials in it. The SSERD can be difficult to locate on the Internet, and it can be time-consuming to use (especially for those with slow modems). Materials that are available only in hard-copy cannot be accessed through the SSERD. Some of these issues were already among those slated to be addressed in future upgrades of the SSERD; others are new issues that must be added to the list of future SSERD improvements.

This feedback from the Chicago conference, the SSAC E/PO Task Force, and the PERG evaluation group sets much of the future OSS E/PO agenda, as is described in the following section.

*“We will give serious attention to improving the coherence of the vast array of space science educational resources that we produce and offer.”*

— NASA FY 2002 Performance and Accountability Report

## SUMMARY AND FUTURE PLANS

In many ways, FY 2002 was a turning point for the NASA Office of Space Science (OSS) Education and Public Outreach (E/PO) Program. It marked a transition from an initial phase focused on establishing the program's infrastructure and nurturing its very rapid start-up to a more mature phase focused on paying much greater attention to improving the program's quality and impact. The Chicago OSS E/PO Conference was a major event marking this transition. The intense interest and enthusiasm shown by the nearly 300 scientists and educators in attendance was a rousing community endorsement of the successes, to date, of the OSS E/PO Program. At the same time, critical feedback from the conference participants foreshadowed the more formal feedback later received in reports from the E/PO Task Force and

the PERG evaluation group. Responding to this feedback is the major program priority for FY 2003 and beyond.

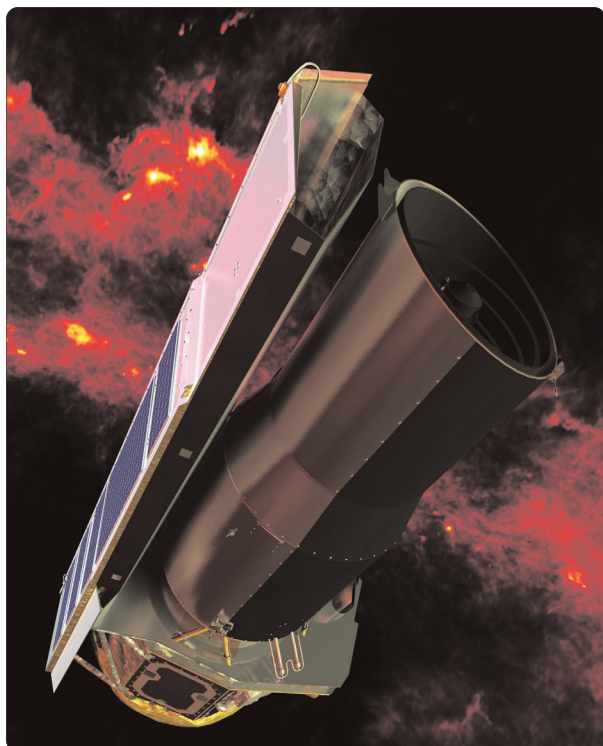
The general priority will be to build on the foundation that has already been established while emphasizing improving the quality and impact of OSS E/PO efforts and extending their reach into new areas. In so doing, further steps will be taken to coordinate OSS E/PO efforts with other similar efforts being undertaken throughout NASA in order to optimize our contribution to the Agency's overall education program.

The coherence of NASA space science materials for educators will be improved by building a framework that will show the appropriate standards-aligned sequencing of space science topics throughout the K–12 years. This will provide overall direction and context for the materials being produced by individual missions. To assist educators in locating useful materials, an increased emphasis will be put on evaluating materials for quality and impact and on improving the search and dissemination mechanisms available through the Space Science Education Resource Directory (SSERD).

Coherent and sustained professional development will be provided for personnel who are engaged in NASA space science education and public outreach in order to increase the effectiveness of their work in education. For OSS E/PO professionals, training in standards and in the practical results from education research will be provided. For space scientists, training aimed at developing a familiarity with education practices will be provided and opportunities to improve presentation techniques will be offered. For educators, opportunities to improve awareness, competency, and leadership in the use of OSS materials that are tied to the space science framework discussed above will be offered.

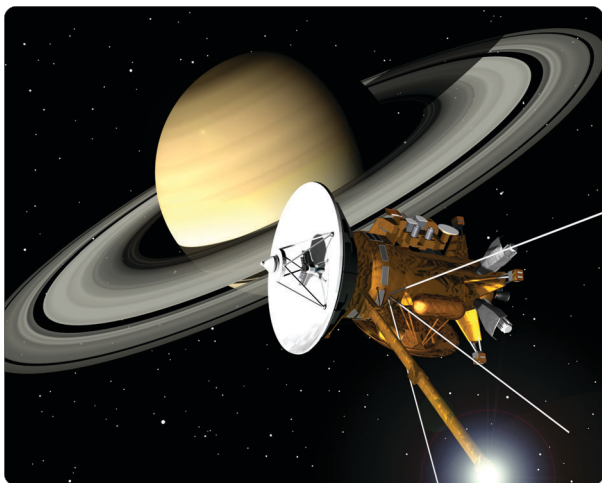
Major opportunities for students to work directly with NASA space science missions, facilities, and data are anticipated in the coming years. Most notably, as new observatories are launched, new spacecraft arrive at Mars, and far future missions examine icy bodies in the outer Solar System, the quantity of data received at Earth will increase substantially. This will allow an ever-increasing number of students the opportunity to become directly involved in space science research and to make genuine discoveries, as they are given access to images and data that, in many cases, have not yet been critically examined by professional scientists.

OSS efforts to provide opportunities for an increasingly diverse population to participate in space science missions, research, and education and outreach programs will be expanded. A new call will be issued in FY 2003 for proposals from minority institutions that are interested in developing space science capabilities on their campuses. Partnerships with special-interest organizations such as professional societies of minority scientists will continue to be developed and enhanced, and new working partnerships with the diversity initiatives of scientific professional societies will be established.



The launch of the SIRTF observatory will focus attention on infrared wavelengths. (Credit: NASA Jet Propulsion Laboratory)





An artist's conception shows the Cassini spacecraft approaching Saturn, the subject of the *Ringworld* planetarium show. (Credit: NASA Jet Propulsion Laboratory)

The utility and availability of OSS E/PO activities and products will be extended to an increasingly broad population, including such groups as persons with disabilities, girls and women, and residents of rural areas.

The strong partnerships that OSS has developed with the science center, museum, and planetarium communities will continue. At the close of FY 2002, major activities planned for FY 2003 included the debut of *Ringworld*, a new, updateable planetarium show about Saturn that is being developed in a partnership between the Cassini mission and Sullivan Presentations of Salt Lake City, UT. The *Cosmic Questions* exhibition was scheduled to begin its national tour with stops at the Midland Center for the Arts in Midland, MI, and the Orlando Science Center in Orlando, FL. The large version of the *Hubble Space Telescope: New Views of the Universe* exhibition was scheduled to visit the U.S. Space & Rocket Center in Huntsville, AL, and the small version was scheduled for stops at the Virginia Air and Space Center in Hampton, VA, the Kirby Science Discovery Center in Sioux Falls, SD, the U.S. Space & Rocket Center in Huntsville, AL, and the Miami Museum of Science in Miami, FL. Finally, the *MarsQuest* exhibition was expected to visit the Lafayette Natural History Museum in Lafayette, LA, the Liberty Science Center in Jersey City, NJ, and the Boonshoft Museum of Discovery in Dayton, OH.

Opportunities to use natural phenomena as vehicles for exploring basic issues in space science education will continue to be exploited. The next *Sun-Earth Day* was scheduled for March 18, 2003, with a focus on auroras, and it centered on the debut of two new Passport to Knowledge science specials, *Auroras—Living With A Star* and *Live From The Aurora*. The release of a new children's book and Web site, *Auroras: Mysterious Lights in the Sky*, featuring striking images of real auroras, was planned in conjunction with *Sun-Earth Day*, and a math and science television special, *Dancing in the Night Sky*, was scheduled to follow shortly afterwards as part of the

NASA Connect series. Looking farther ahead, a rare transit of the Sun by the planet Venus will occur on June 8, 2004. This event offers OSS an opportunity to highlight the historical significance of such an event in making scientific observations that range from studying the atmosphere of Venus to determining the distance scale of the Universe.

Mars will be a major focus in FY 2003 and FY 2004, with the twin Mars Exploration Rovers scheduled for launch in June or July 2003 and landing on Mars in January 2004. Activities planned in conjunction with these events include new television specials and partnerships with science museums to bring Mars exploration to the public.

Another new NASA space science guide for middle school teachers is slated to be added to the Lawrence Hall of Science's Great Explorations in Math and Science (GEMS) series in FY 2003. *Living With a Star: From Sunscreen to Space Weather*, developed by the NASA Sun-Earth Connection Education Forum, allows students to explore the Earth's dynamic relationship to the Sun through such vehicles as a space-weather mystery, a mock mission to outer space, and ultraviolet experiments.

Evaluation will continue to be a major area of emphasis for OSS. The final report from the Space Science Advisory Committee (SScAC) E/PO Task Force and additional results from Phase III of the PERG evaluation study are expected in FY 2003. Responding to such external findings and recommendations will be a top priority for FY 2003 and beyond.

The OSS E/PO Program looks forward to continued growth, continuous improvements in effectiveness and educational impact, increasing efforts to reach nontraditional audiences, and greater cohesiveness both within the OSS E/PO Program itself and with other NASA education efforts. OSS is pleased to be making these contributions as an integral part of NASA's efforts to inspire the next generation of explorers. The unique character and universal appeal of OSS missions and scientific programs allow us to truly inspire and motivate students and to engage the public in ways that only NASA can.



NASA Goddard Space Flight Center scientists Art Poland (left) and Rich Vondrak (right) demonstrate the behavior of Earth's magnetic field near the North Magnetic Pole for *Auroras—Living With a Star*. (Credit: *Passport to Knowledge*/Geoff Haines-Stiles)